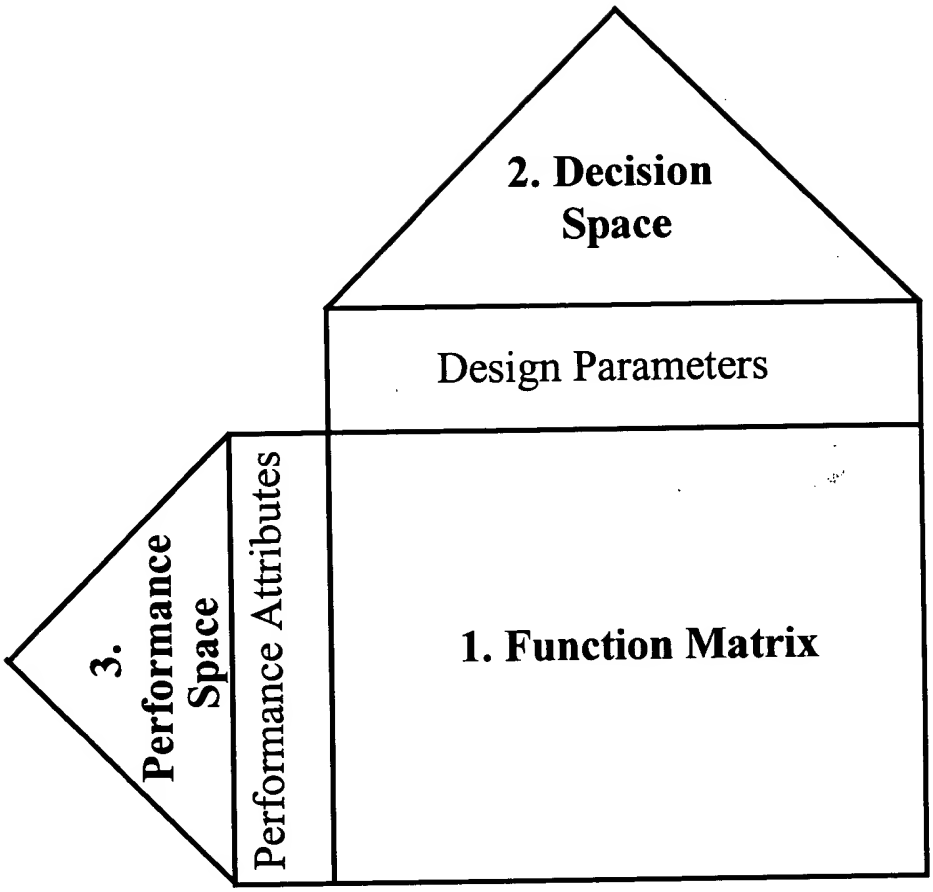

2. Decision Space
Design Parameters
1. Function Matrix
3. Performance Space
Performance Attributes

FIG. 1

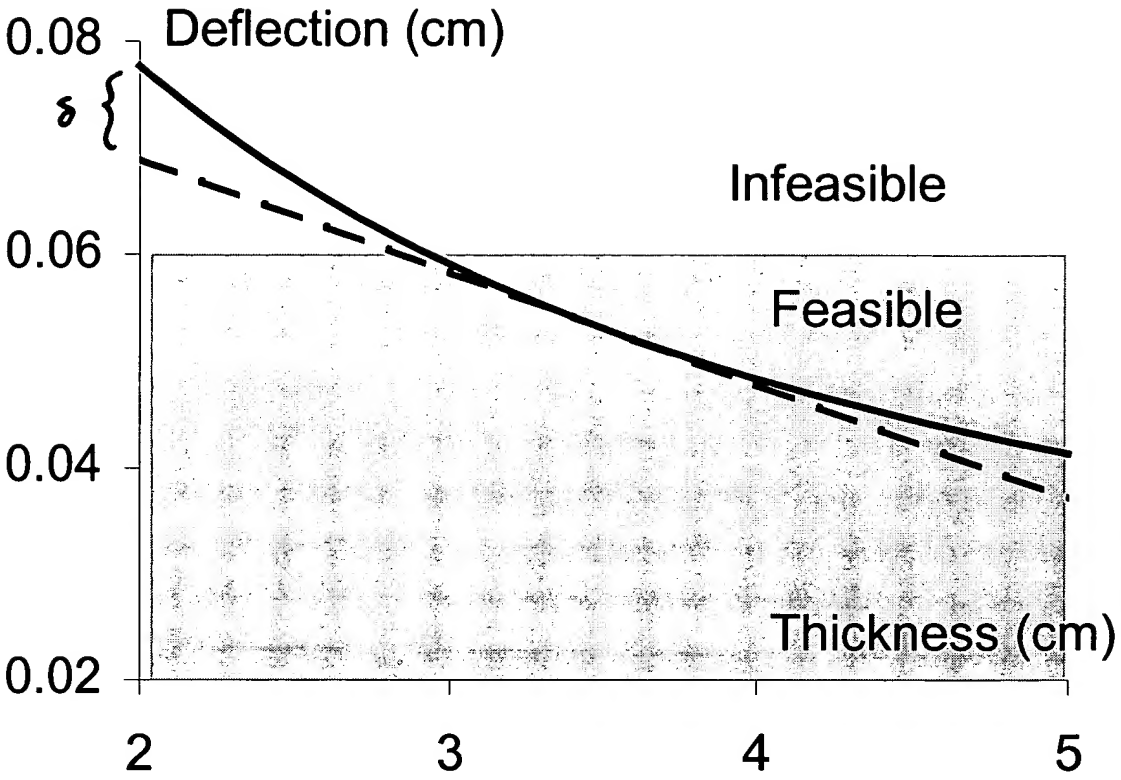

0.08
Deflection (cm)
δ
Infeasible
0.06
Feasible
0.04
Thickness (cm)
0.02
2
3
4
5

FIG. 2

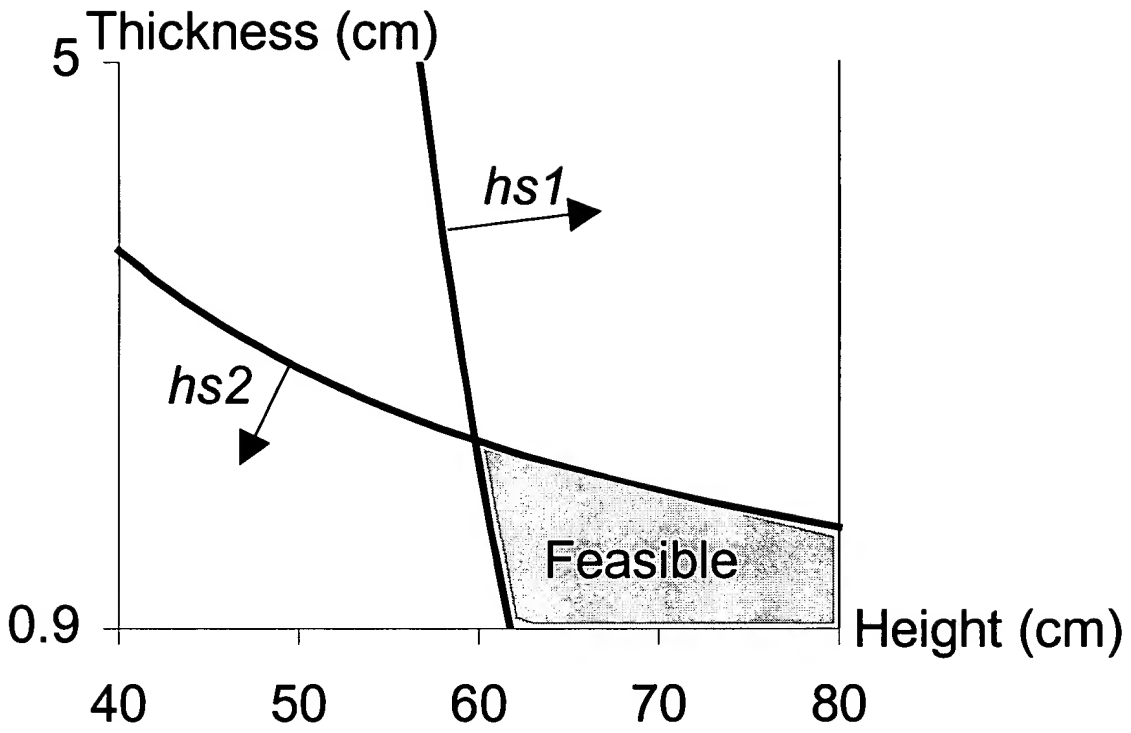


FIG. 3

1. Initialize the loop

$lp1 = \{ (LCL_i, LCL_j), (LCL_i, UCL_j), (UCL_i, UCL_j), (UCL_i, LCL_j), (LCL_i, LCL_j) \},$

$k = 1.$

2. Create the half space hs defined by the specification k:

$$hs = \{X \in R^n \mid f_k(X) \geq LSL_k\}.$$

For two-side specifications, repeat Step 3~5 for USL_k.

3. Set $lp0 = lp1$,
   $v_a = v_1$, and
   $v_b = v_2$.
   Empty $lp1$;

4. If both v_a and v_b are inside hs then
   add v_b into $lp1$;
   else
   if one of v_a and v_b is inside hs then
   calculate the intersection point v_c of $v_a v_b$ and hs
   add v_c into the new loop $lp1$

   if v_b is inside hs then
   add v_b into $lp1$.

5. Set $v_a = v_{a+1}$ and
   $v_b = v_{b+1}$.
   If not all vertices are done, go to step 4.

6. $k = k + 1$. If $k \leq n$, go to step 2.

7. Add the first vertex into the end of $lp1$ to finish the loop. The region surrounded by $lp1$ is the feasible space of x_i vs. x_j with other parameters fixed.

FIG. 4

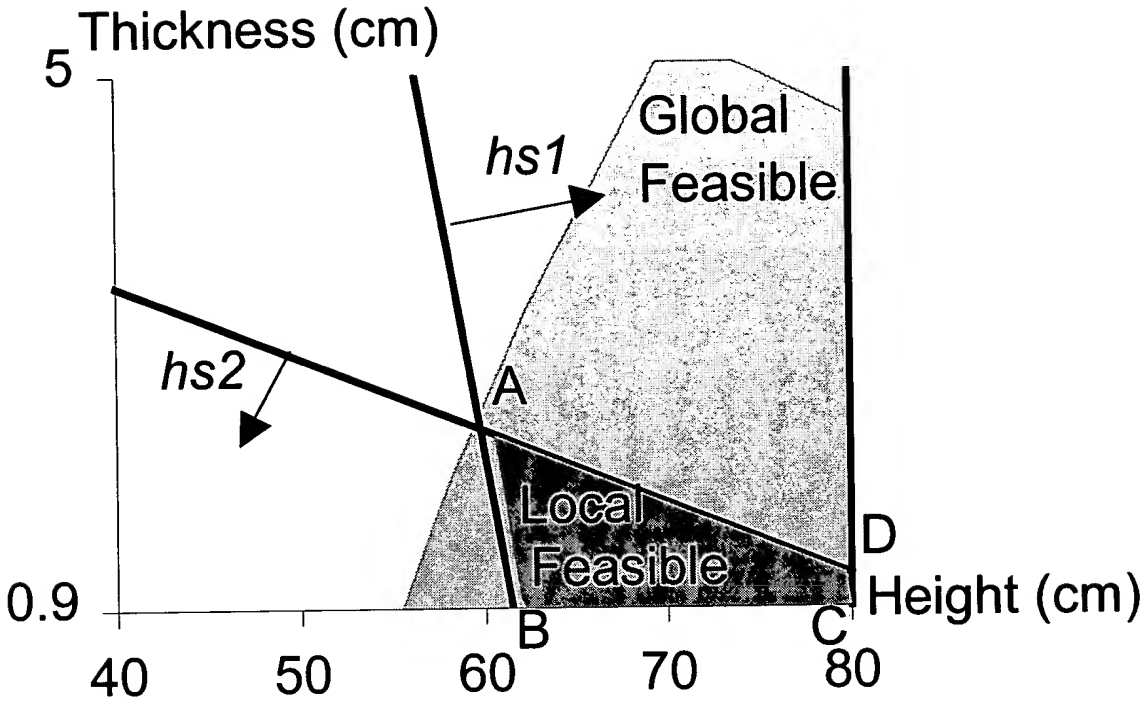

Thickness (cm)
5
0.9
Global
Feasible
hs1
hs2
A
Local
Feasible
B
C
D
Height (cm)
40
50
60
70
80

FIG. 5

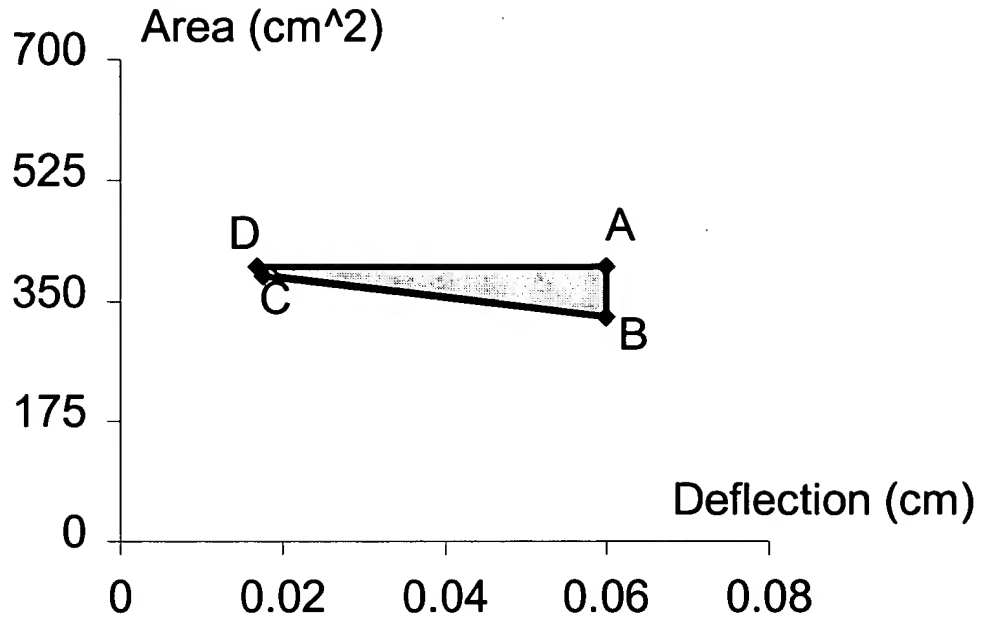


FIG. 6

1. Choose n distinctive constraints from all m specifications and n parameter limits;

2. LU decompose $\boldsymbol{F}$ into $\boldsymbol{L \cdot U}$;

3. Constitute one distinctive right-side $\boldsymbol{Y}$ from specifications and parameter limits.

4. Solve $\boldsymbol{L \cdot U \cdot X} = \boldsymbol{Y}$ by forward and back substitution. If the solution X^* satisfies all the specifications, add it into the extreme point list.

5. If all distinct $\boldsymbol{Y}$s have been operated upon, go to next step. Otherwise go to step 3.

6. If all distinct constraint combinations have been operated upon, go to next step. Otherwise go to step 1.

7. All extreme points and the facets are now available. The feasible decision space and performance space can be acquired by projecting the facets into each 2-dimensional viewing pane, though other projections and representations may be beneficial.

8. The boundary of the feasible space in each viewing pane is a convex hull of the extreme points. Graham-scan algorithm can be adopted to retrieve the convex boundary in $O(h\lg(h))$ time where h is the number of all vertices.

FIG. 7

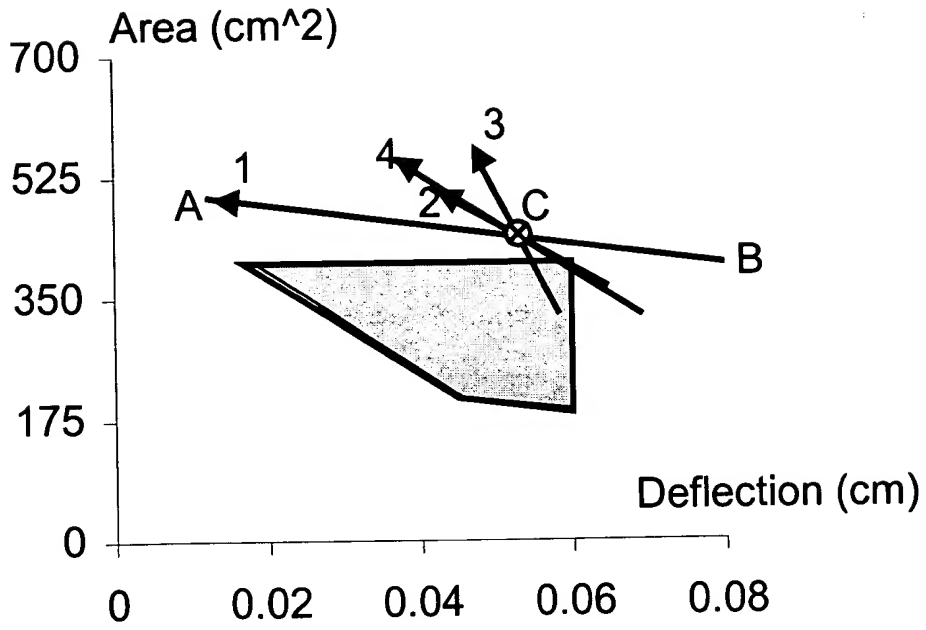

Area (cm^2)
700
525
350
175
0
0
0.02
0.04
0.06
0.08
Deflection (cm)
A
B
C
1
2
3
4

FIG. 8

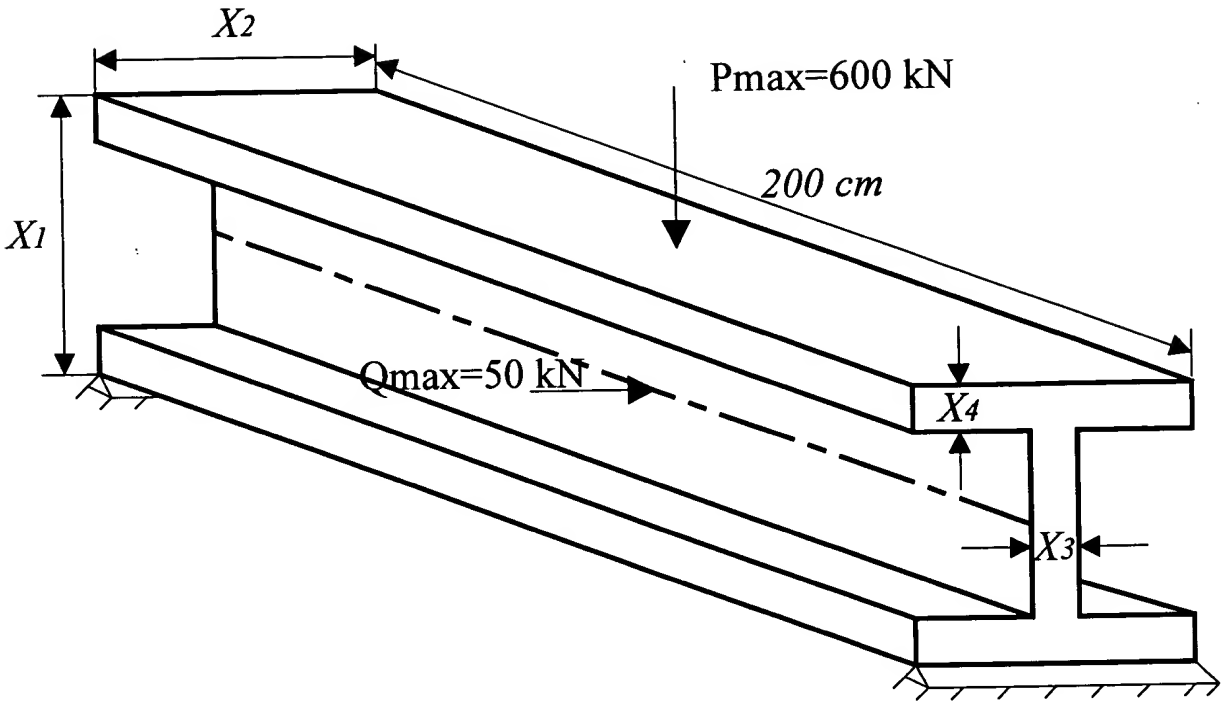


FIG. 9

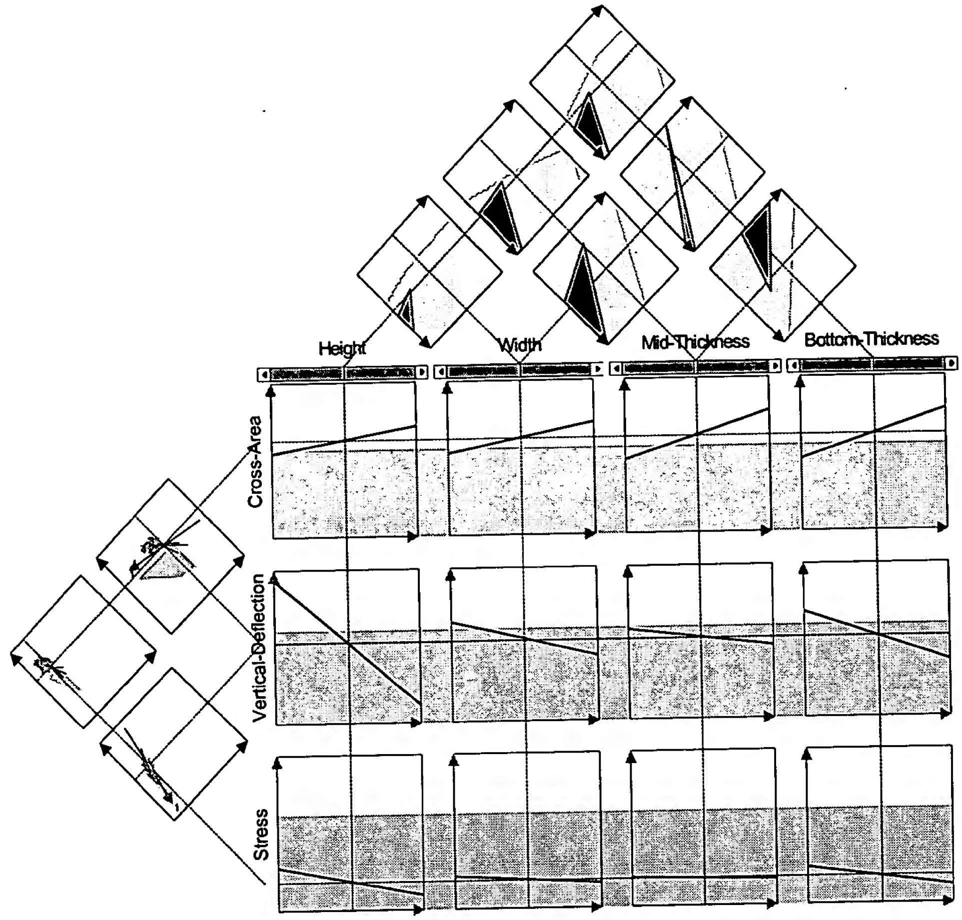


FIG. 10

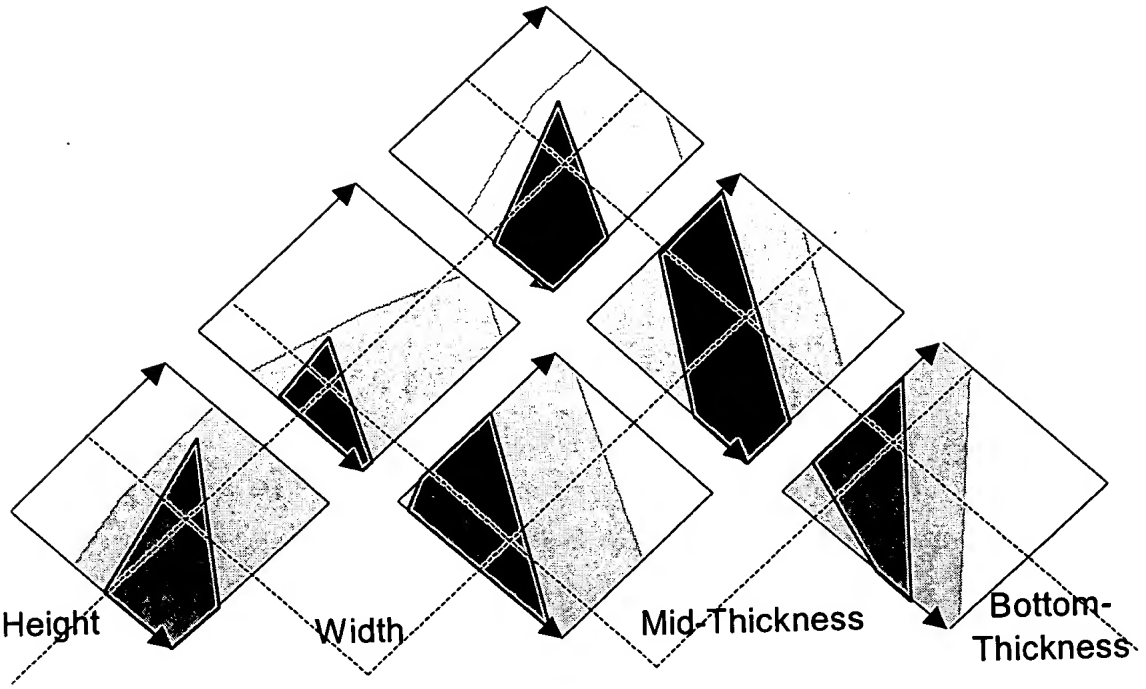


FIG. 11

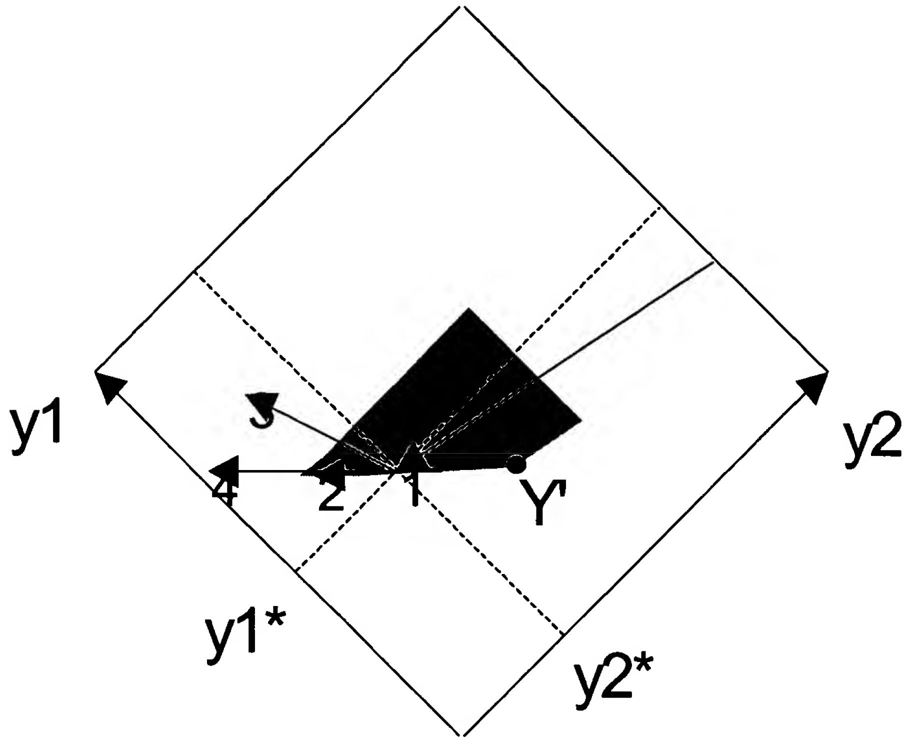
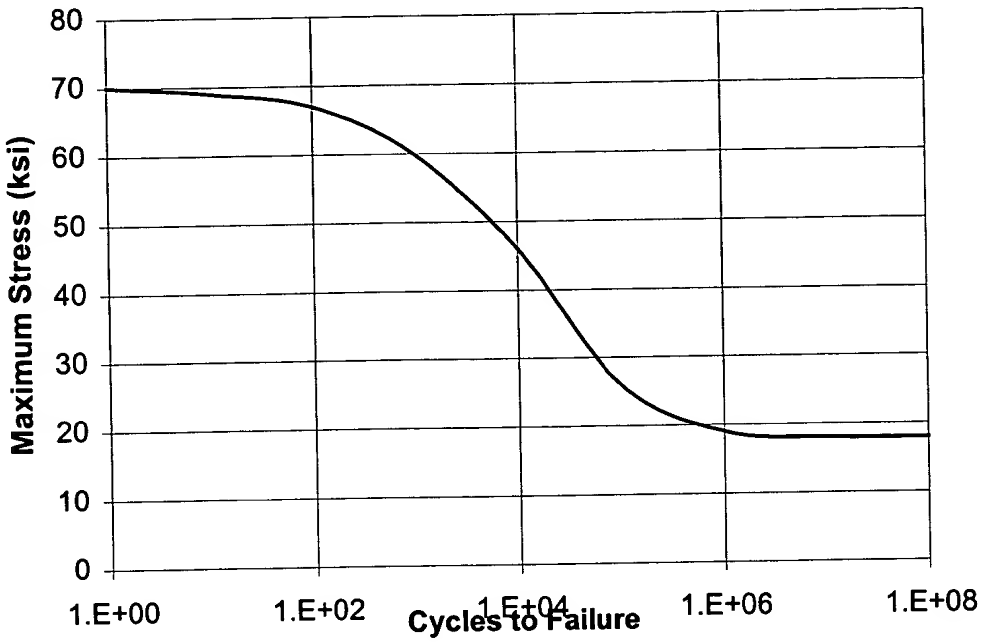


FIG. 12



Maximum Stress (ksi)
80
70
60
50
40
30
20
10
0
1.E+00
1.E+02
1.E+04
1.E+06
1.E+08
Cycles to Failure

FIG.13

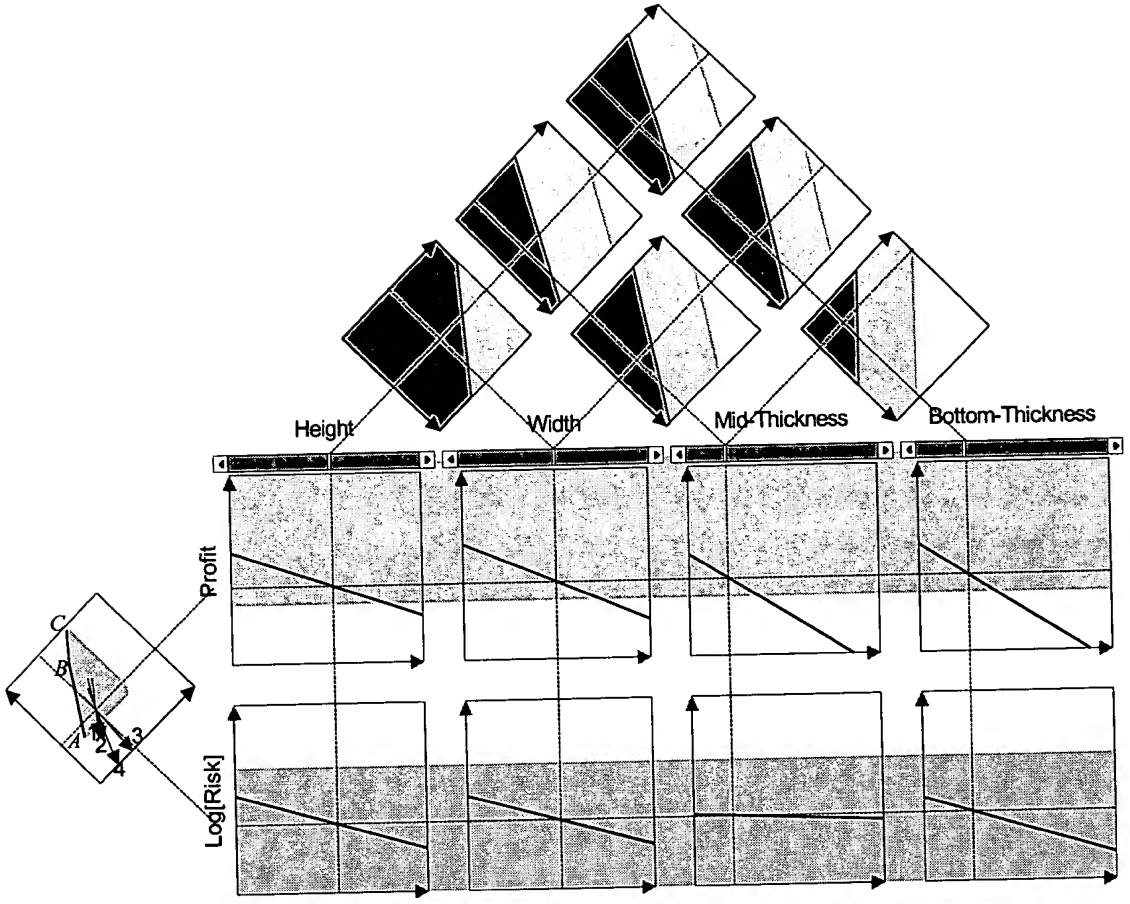

Height
Width
Mid-Thickness
Bottom-Thickness
Profit
Log[Risk]
C
B
A
1
2
3
4

FIG. 14

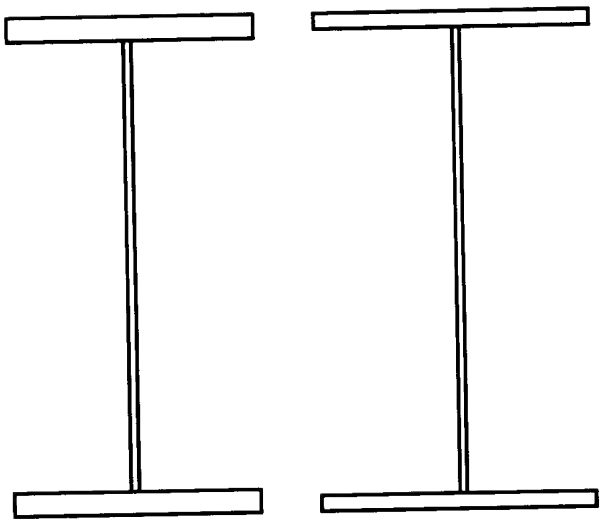


FIG. 15